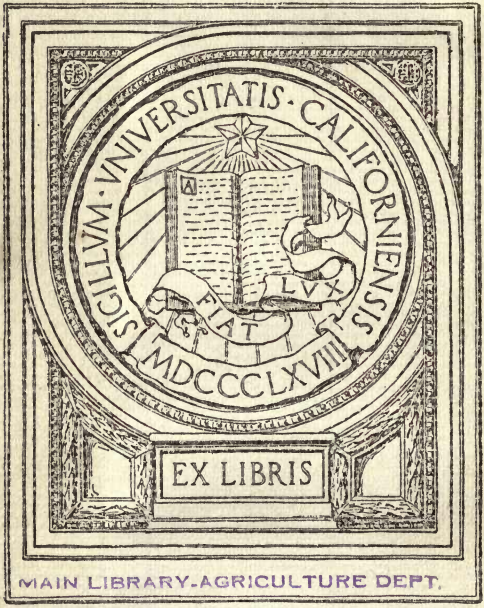

RRIGATED AGRICULTURE

The Dominant Industry of California

BY

S. FORTIER

Charge Pacific District Irrigation and Drainage Investigations
United States Department of Agriculture

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IRRIGATING VINEYARD

IRRIGATED AGRICULTURE

The Dominant Industry of California

California has always been considered a state of great possibilities. Her mines and her commerce and her climate and agriculture have long been the theme of inspiring pen-pictures. With a range of climate and soil and of mountain and valley more varied than that possessed by any of her sister states, with a geographical position and commercial facilities naturally favorable to intensive development, she has ranked as the leader in the upbuilding of western America. But while her gold, her seaports, her forests and commerce have made her position unique among the states, her future has always been considered bound up in her agriculture. Over half a century of development has shown that if this agriculture is to be the best of which the state is capable,

it must be founded on irrigation, and for years the careful husbandman has, over a large portion of the state at least, made the artificial application of water to land an important part of his industry. Hence it is that any treatment of irrigation in California must consider not only what has been accomplished but what seems possible of accomplishment in the future.

The total land area of California is approximately one hundred million acres. According to conservative estimates based on the irrigation census of 1902, two million of those acres are being watered at this time. This statement, however, does not convey a true idea of the relative importance of irrigation to agriculture in California. Professors Hilgard and Loughridge, of the University of California, estimate that only fourteen million acres, or about one-seventh of the total area, is valley agricultural land, so that the two million acres irrigated comprise one-seventh of the irrigable land of the state. This estimate does not include the tillable upper mesas and mountain valleys, both of which contain large areas of irrigable land. Yet this is not the whole truth. In 1902, one-

IRRIGATING AN ORANGE GROVE

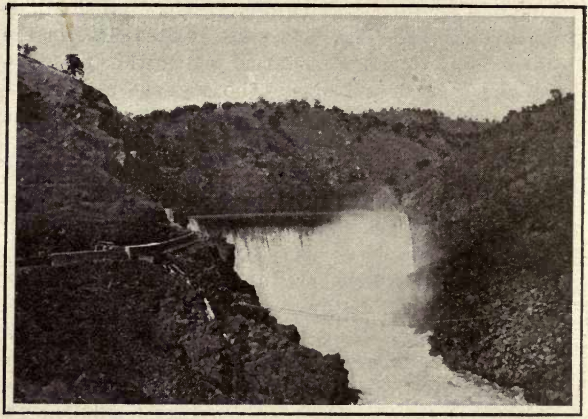
quarter of all the irrigated land in the United States was in California, and this state ranked first in the total number of irrigated farms and in the total construction cost of systems. The highest priced irrigated land in America is found in California, and in no other state has water for irrigation reached so high a value, or been as carefully and as economically used. And in no other state is there so great an area of fertile farming land for which the available water supply is so large.

Irrigation development in California, like other developments, has followed the lines of most evident financial returns. So it is that the localities of least annual and summer rainfall were the first to be reclaimed by the artificial use of water. The tide of irrigation, however, has been moving steadily northward, and excepting in the mountainous sections and the sections of excessive rainfall, the necessity for irrigation, or at least the value of it where it is not a complete necessity, is almost universally recognized. While heretofore, then, irrigation has followed the line of most evident return, in the future it will follow the available water supply.

The water supply of the state is in its streams and wells. The wells now dug and in use are chiefly in Southern California and in the lower San Joaquin and the Santa Clara Valleys. Only the larger streams of the State have been measured and without reliable data it is impossible to estimate the flow in the hundreds of smaller streams. The supply in the larger streams is distributed as shown in the following summary.

Total mean annual flow of California streams in acre-feet.

Location of streams	Acre-feet
In Sacramento Valley.....	15,000,000
In San Joaquin Valley.....	19,000,000
In Salinas Valley.....	500,000
In Southern California	170,000
Total,	34,670,000



LA GRANGE DAM OF THE TUOLUMNE

Leaving out of consideration the water supply available in the creeks and smaller rivers, thirty-four million acre-feet of water is sufficient to cover the fourteen million acres of agricultural land in California to a depth of two and one-half feet, which in most soils is ample for the growth of all crops This vast quantity of water can never be entirely used in irrigation because it cannot be fully controlled, but the statement of it shows the tremendous potentialities of California irrigated agriculture.

What California is now accomplishing by irrigation can partly be told by using as a basis the irrigation census of 1902. According to this census, 1,708,720 acres was irrigated in 1902, which was an increase of 18.2 per cent over the area irrigated in 1899. From 1902 to 1905 the increase has been more rapid, so that it is safe to assert that over 2,000,000 acres are being watered at this time. This vast area, comprising 35,000 irrigated farms, is raising one-third of the total agricultural produce of the State, and taking into consideration the present high value of irrigated crops, particularly of alfalfa, it is reasonable to con-

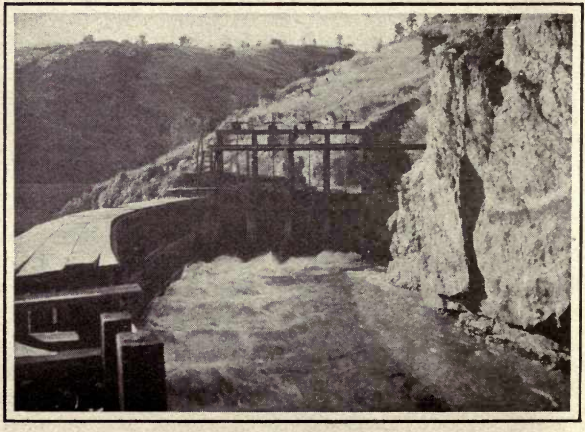
clude that these irrigated lands produce, on an average, crops to the value of $25 per acre, or $50,000,000 per annum. Using the figures that were true up to 1902 as a basis, the total cost of systems which make this return possible has been over $27,000,000, or over $13.50 per acre. The significance of this last figure is apparent when it is remembered that it is nearly one-half the total value of land and buildings invested in manufactures in California in 1900.

It has already been stated that irrigation was first resorted to in California in those sections where a profit from irrigation was first most evident. These sections have of course been where the rainfall is least. In that portion of the state south of Tehachapi commonly known as Southern California, the development of irrigation was rapid, continuing with bounds until the water supply available in the streams was practically exhausted. Since then the irrigated area has been extended only by resort to pumping from wells and by endeavoring to make the water already diverted irrigate two acres where it irrigated only one before. The total area irrigated in Southern California, from streams, in 1902 was 57,482 acres, and probably 150,000 of the 182,211 acres irrigated from wells and springs are south of Tehachapi, making a total for Southern California of 207,000 acres, or 9.7 per cent of the 2,000,000 acres watered in the entire state. This does not include the irrigation from Colorado River, which was about 10,000 acres in 1902, but which is much increased since then. North of the Tehachapi, the largest area irrigated was from the San Joaquin Valley streams, principally San Joaquin, Kings and Kern Rivers. Here a total of 908,182 acres received water, which was 53 per cent of the total irrigated area. From Sacramento River and tributaries only 194,900 acres were being irrigated, and the remaining land under water was located on independent streams throughout the state. Outside of Southern California, the principal

areas irrigated from wells and springs were located in the lower San Joaquin and in Santa Clara Valleys.

The foregoing is a brief statement of what has been accomplished by private enterprise during less than half a century in reclaiming a portion of the irrigable lands in California. The attention of the reader has likewise been called to the natural resources in both land and water which remain undeveloped, awaiting the concerted action of industrious farmers. Notwithstanding the magnitude of this task, we believe that it can be accomplished. The same intelligence, energy and perseverance which wrested two million acres from barren sands and unproductive grain fields and made them yield crops worth fifty million dollars a year can reclaim other millions of acres.

What is most needed in this state and what we should most highly prize is an influx of industrious settlers, each possessing sufficient means to enable him to make a fair start along the line of irrigated agriculture. The opportunities open to this class are exceptionally good. All of the natural advantages essential to the success of the irrigated farm are to be found in the Great Central Valley of California—

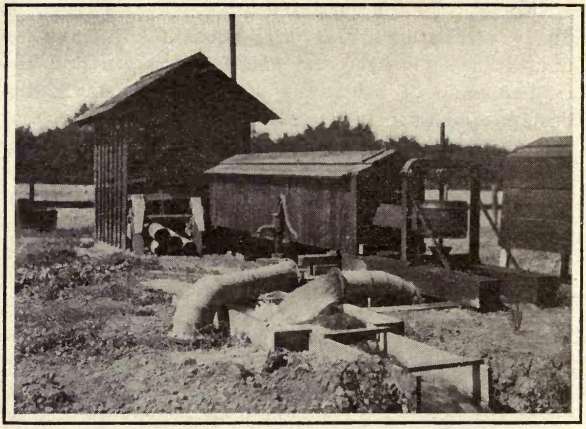


HEADGATES ON TURLOCK CANAL

fertile soil, good climate and an abundant water supply. Yet these natural gifts count for little when unutilized. We need the intelligent brain and the trained hand of thousands of farmers to make the best possible use of these advantages. In much of this work no large amount of capital is required. The individual, mutual company and irrigation district can reclaim an additional two million acres in a manner similar to the successful efforts of like agencies in the past. In this connection it may be a surprise to some to learn that there are nearly a million acres of rich valley land now under ditch, but which is not irrigated on account of lack of settlers. Much of this land is for sale at reasonable prices. The water supply for a much larger area is readily accessible and both land and water can be united under the most favorable circumstances whenever a sufficient number of citizens join to bring it about.

This dominant industry of California is in no danger of languishing for a few years to come on account of the lack of irrigation canals and storage reservoirs. The state is now filling up at the rate of about 100,000 people a year and there is sufficient unirrigated land now under canal systems to provide for the farmers among the newcomers for the next ten years. The settlers should understand, however, that there are difficulties in the way of irrigation in California, as there are wherever irrigation is practiced. A brief review of some of these may not be out of place.

It has been stated that nearly a million acres of fertile valley land is now under ditches, but unirrigated. Much of this land has been cultivated for years, but it does not necessarily follow that it is ready to receive water. It may cost on an average of $15 per acre to construct permanent farm ditches and to prepare the surface for irrigation. The exact cost of this depends upon the method of irrigation to be followed and the degree of refinement practiced in the preparation of the ground. Definite statistics and figures regarding this are available in



PUMPING PLANT IN SANTA CLARA VALLEY
Run by electric power and discharging 950 galls. per minute

numerous publications, but notably in Bulletin 145 of the Office of Experiment Stations of the United States Department of Agriculture. This bulletin tells not only the experience of irrigators in California, but of irrigators throughout the West. If the task of preparing land is attempted by settlers from the humid states without their first making every effort to avail themselves of the experience of older irrigators, partial failures at least will be apt to result. And in addition to the perplexities of preparing land for irrigation, others equally trying are quite sure to be encountered in applying water to land. Most beginners use too much water. The evils of this, including the waste of valuable water and injury to crops and soil, are apt to be considerable, and every effort should be made to see that they are avoided. Requirements and practice vary with localities, but in every locality there are some careful irrigators whose advice, well mixed with common sense, will help to guide the newcomer along a safe path.

Besides the practical difficulty of preparing land and applying water, the irrigator in California must give careful attention to problems of rightful ownership and equitable distribution of water. Nature usually provides an abundant quantity of snow on the elevated ranges to supply the soil of the valleys with the requisite amount of moisture, provided it is properly husbanded or made available for use at the proper time by storage; but the State, unfortunately, has failed to make adequate provision for determining the rights of claimants to water or for distributing to each his equitable portion. As conditions now exist, some receive too much, while others receive too little. It is to be hoped that before long the State will do as much toward protecting the rights of irrigators as some of the other western states have done. In the meantime, with their characteristic determination to do things in spite of difficulties, Californians are making the best they can of the opportunities that are afforded. With more Californians these difficulties will grow less, because with an increase in population and a higher development of irrigated agriculture, there is bound to result on the part of the State a larger and better understanding of the needs of peaceful and successful growth.

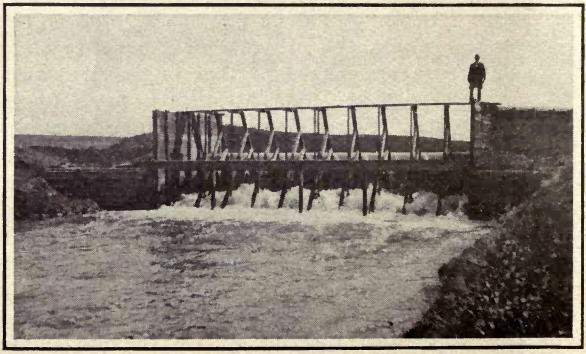
The cultivation of the soil rendered productive by the use of water constitutes the leading industry of California. Being thus dependent to a large extent on soil and water, the progress of the entire state may be accurately gauged by that of irrigated agriculture. Through the liberality of the State Legislature and the Federal Government, appropriations have been made to assist all those who are endeavoring to make arid or partially arid lands productive. This work as regards that branch which is conducted by the Irrigation and Drainage Investigations of the U. S. Department of Agriculture comprises the following lines of investigations: (1) The proper way to prepare the surface of land to receive water and the best method of applying it; (2) the prevention

of waste in irrigation water; (3) pumping water for irrigation; (4) the use and distribution of water in irrigation districts; and (5) the value of water in fruit raising.

The field is so large and there is so much that might be done that it is difficult to decide which shall be undertaken first. In briefly reviewing what has been accomplished during the past year the value of each line of investigation to the people of California may be better understood.

Several million acres of fertile valley soil are now cultivated without the use of water and of this vast area about one million acres has been placed under ditch and can be purchased at low rates and successfully irrigated. The yearly influx of people to California is probably not far from 100,000 and of this number a large proportion is seeking small farms which can be irrigated. The ultimate success of these new settlers will depend to a considerable degree in beginning right. We feel confident that a recent publication of this office, describing suitable methods of preparing land and applying water, has done much to assist this class.

In some portions of California water is still cheap and abundant and irrigators use it with a lavish hand. Even under these favorable conditions it should not

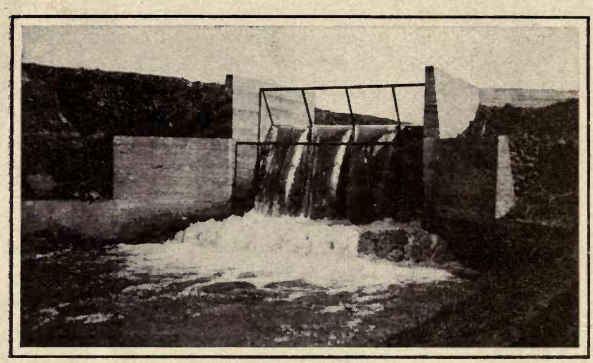


WOOD DROP ON MODESTO CANAL

be wasted, for good land is often damaged by an excess of water. In other portions of the state water is scarce and is yearly becoming more valuable. How to conserve it by preventing waste is one of the most important problems. Before applying a remedy it was necessary to find out what percentage was wasted. This has been done by ascertaining the seepage losses from ditches and canals, the amount of moisture evaporated from soils, and the waste caused by faulty methods of preparing the surface and applying the water. These combined losses are so great that large expenditures are warranted in reducing the waste.

The owners of pumping plants in California are expending from one to two million dollars annually in raising water from wells. In studying the results of a large number of mechanical tests of such plants which have been made by our engineers during the past year, it is evident that a great saving can be effected. The greater number have one or more defects which lessens their efficiency and which, if pointed out, might be remedied in many cases at small cost. Other plants are not well adapted to the work which they are made to perform, or else are not operated in a way to secure the highest efficiency. The cost of pumping water can be still further reduced by the establishment of central power plants which will generate electric current to operate the pumps that are now dependent on separate plants. In this way, one central plant might do the work of 100 individual plants at less than one-half the cost. The results of the investigations on pumping plants have been compiled and are now being printed by the Government.

Another bulletin now in the hands of the Government printer, deals with the use and distribution of water in the Modesto and Turlock Irrigation Districts. The people of these districts, after more than a decade of continuous litigation, have compromised their differences and joined hands in a determined



15 FT. CEMENT DROP, MODESTO CANAL

effort to win success. The wonderful progress which they have made in the past two years cannot but prove helpful to a score or more of similar districts which have not as yet effected their reorganization. It is largely with a view to encouraging these laggards that the work in the Modesto and Turlock Districts was undertaken. The publication treats of the amount of water needed for the production of crops, the loss by seepage, the keeping of records of canal flow, and a complete system for the equitable distribution of the water.

A report on the value of irrigation in fruit growing is likewise in press, and may soon be obtained by the orchardist of California. The investigation was confined to localities having an annual rainfall of from 15 to 25 inches and where fruit can be produced by the natural rainfall. The result, however, was the fullest demonstration of the value of irrigation water in securing the full and perfect development of the fruit.

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